PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-205062
(43)Date of publication of application : 05.08.1997

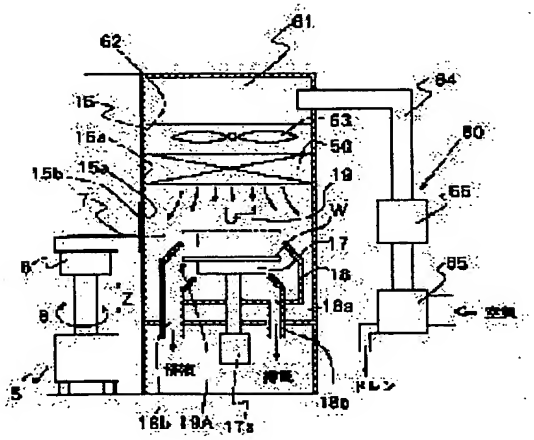
(51)Int.CI. H01L 21/027
B05C 11/06
B05C 11/08
B05D 1/40
G03F 7/16

(21)Application number : 08-031248
(22)Date of filing : 26.01.1996

(71)Applicant : TOKYO ELECTRON LTD
(72)Inventor : AOYAMA TORU

(54) RESIST COATER

(57)Abstract:
PROBLEM TO BE SOLVED: To make uniform a resist film and to enhance throughput by shortening the time for forming a resist film.
SOLUTION: A spin chuck 17 for holding a semiconductor wafer W horizontally and rotatably is disposed, along with a nozzle 19 for supplying resist liquid onto the surface of a semiconductor wafer W, in a processing vessel 16 sectioned from the outside. The processing vessel 16 is provided with a dry air introduction port 16a above the spin chuck 17 and a dehumidifier 65 is arranged, along with a temperature controller 66, on a dry air supply path 64 communicating with the dry air introduction port 16a. Since a positive pressure can be set in the processing vessel 16 with respect to the outside and humidity can be set at 40% or below, evaporation of solvent in resist liquid is accelerated and the time required for forming a resist film is shortened thus enhancing throughput.



LEGAL STATUS

[Date of request for examination] 30.10.1998
[Date of sending the examiner's decision of rejection] 13.03.2001
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's

decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The resist coater characterized by considering as a low humidity ambient atmosphere while rotating a processed object, carrying out partition formation of the processing room of the above-mentioned processed object in the above-mentioned equipment with the exterior, introducing dry air into the processing interior of a room in the resist coater which forms the resist film in a processed body surface while supplying resist liquid to the front face of a processed object, and making the processing interior of a room into a positive pressure ambient atmosphere to the exterior.
[Claim 2] In the resist coater which is made to rotate a processed object and forms the resist film in a processed body surface while supplying resist liquid to the front face of a processed object The installation base which holds the above-mentioned processed object horizontally pivotable, and a resist liquid supply means to supply resist liquid to a processed body surface The resist coater characterized by the thing arrange in the exterior and the processing interior of a room divided, arrange a desiccation air induction inlet above the above-mentioned installation base in the above-mentioned processing room, and it comes to arrange a dehumidification means and a temperature control means in the desiccation air supply way which is open for free passage to the above-mentioned desiccation air induction inlet.
[Claim 3] The resist coater according to claim 1 or 2 characterized by setting up the humidity of the above-mentioned processing interior of a room to 40% or less.
[Claim 4] The resist coater according to claim 1 or 2 characterized by setting up humidity to 40% or less while making temperature of the above-mentioned processing interior of a room into 23 degrees C.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a resist coater.
[0002]
[Description of the Prior Art] Processing liquid, for example, photoresist liquid, is applied to semi-conductor wafers (a wafer is told to below), such as a processed object, for example, a silicon substrate etc., a circuit pattern etc. is reduced to the production process of a semiconductor device using a photograph technique, the photoresist film is exposed to it, and there is a series of down stream processing which carries out the development of this in it. This down stream processing is called photolithography.
[0003] This down stream processing is a very important process in high integration of a semiconductor device, and in this process, in order to form the resist film in the front face of a processed object, for example, a wafer, at homogeneity, careful caution and time amount are spent. After this resist spreading process moves a nozzle and applies resist liquid to a wafer front face from a nozzle while holding the wafer conveyed by resist equipment on an installation base and carrying out a predetermined revolution, it carries out the high-speed revolution of the wafer, diffuses resist liquid, and forms the resist film of predetermined thickness in a wafer front face. Then, the slowdown revolution of the revolution of a wafer is carried out, after breathing out, the penetrant remover, for example, the thinner, from which the resist liquid which turned to the rear face of a wafer is removed, the high-speed revolution of the wafer is carried out again, and swing OFF completes processing for thinner.
[0004] the above-mentioned resist spreading process -- setting -- the resist film -- predetermined thickness -- and since a revolution of a wafer cannot be made extremely high-speed relating with the time amount to which the solvent in resist liquid volatilizes, and the rotational frequency of a wafer in order to form in homogeneity, much time amount is spent.
[0005]
[Problem(s) to be Solved by the Invention] However, when the resist spreading process took time amount, lost time arose in exposure processing of degree process, and there was a problem of causing lowering of productivity.
[0006] This invention was made in view of the above-mentioned situation, and aims at offering the resist coater which shortens the formation time amount of the resist film and enabled it to aim at improvement in a throughput by promoting volatilization of the solvent in resist liquid.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned object, a resist coater according to claim 1 In the resist coater which is made to rotate a processed object and forms the resist film in a processed body surface while supplying resist liquid to the front face of a processed object While carrying out partition formation of the processing room of the above-mentioned processed object in the above-mentioned equipment with the exterior, introducing dry air into the processing interior of a room and making the processing interior of a room into a positive pressure ambient atmosphere to the exterior, it is characterized by considering as a low humidity ambient atmosphere.

[0008] While a resist coater according to claim 2 supplies resist liquid to the front face of a processed object In the resist coater which is made to rotate a processed object and forms the resist film in a processed body surface The installation base which holds the above-mentioned processed object horizontally pivotable, and a resist liquid supply means to supply resist liquid to a processed body surface It is characterized by the thing arrange in the exterior and the processing interior of a room divided, arrange a desiccation air induction inlet above the above-mentioned installation base in the above-mentioned processing room, and it comes to arrange a dehumidification means and a temperature control means in the desiccation air supply way which is open for free passage to the above-mentioned desiccation air induction inlet.
[0009] It is better to set up humidity to 40% or less, while making temperature of the processing interior of a room it being [direction] desirable (claim 3) still more desirable, and setting up the humidity of the above-mentioned processing interior of a room to 40% or less into 23 degrees C in this invention (claim 4).
[0010] Since the processing interior of a room is certainly maintainable in a low humidity ambient atmosphere by making it a low humidity ambient atmosphere while according to this invention carrying out partition formation of the processing room of the processed object in equipment with the exterior, introducing dry air into the processing interior of a room and making the processing interior of a room into a positive pressure ambient atmosphere to the exterior, while being able to shorten the volatilization time amount of the solvent in resist liquid, the time amount which formation of the resist film takes can be shortened. Moreover, since resist spreading processing can be performed according to the exposure processing time after a resist spreading process, while being able to shorten the processing time of the whole process, improvement in a throughput can be aimed at.
[0011]
[Embodiment of the Invention] Next, the gestalt of implementation of this invention is explained to a detail based on an accompanying drawing. This operation gestalt explains the case where the resist coater of this invention is applied to resist liquid spreading and the development system to a semi-conductor wafer.
[0012] The above-mentioned resist liquid spreading and development system arrange 1st cassette 1a which holds the unsettled processed object (a wafer is told to below) W, for example, a semi-conductor wafer, and 2nd cassette 1b which holds the wafer [finishing / processing] W in a predetermined location, as shown in drawing 1 . The pincette 2 for conveyance of the wafer W which performs taking out or carrying in of Wafer W among these cassettes 1a and 1b, and the cassette station 4 possessing the installation base 3 for carrier delivery, The spreading processing section 10 which is adjoined and arranged in this cassette station 4, and forms the resist film in the front face of Wafer W, The development section 20 which carries out the development of the wafer W by which was arranged through the interface section 30 between this spreading processing section 10, and exposure processing was carried out, The body consists of aligners 40 (exposure processing section) which irradiate ultraviolet radiation from the light source through the predetermined mask member M at the wafer W by which was arranged through interface section 30A between this development section 20, and spreading processing was carried out, and expose a predetermined circuit pattern on the resist film.
[0013] The straight-line-like conveyance way 5 is laid by the center section of the above-mentioned spreading processing section 10 and the development section 20, respectively, and this conveyance way 5 is established in the movable conveyance device 6 in it. The wafer conveyance arm 7 which can move to this conveyance device 6 to X, the direction of Y, and a perpendicular direction (Z direction) in the level surface, and can be rotated freely (theta) is formed.
[0014] In the above-mentioned spreading processing section 10, while meets the side edge of the conveyance way 5 of the conveyance device 6, and the adhesion section / cooling section 12 which accumulated and prepared adhesion section 12a and cooling section 12b which perform the brush washing section 11 and hydrophobing down stream processing, and the BEKU section 13 (1st heat treatment section) adjoin a side at a single tier, and it is arranged. Moreover, the

resist coater 15 of this invention that carries out spin coating of the jet backwashing-by-water section 14 and the number (it is specifically usual resist liquid and the resist liquid for acid resisting), for example, the two resist liquid, adjoins a single tier, and is arranged, and opposite arrangement of the resist coater 15 and the BEKU section 13 is carried out through the conveyance way 5 at the another side side of the conveyance way 5. Thus, by carrying out opposite arrangement, where the BEKU section 13 and the resist coater 15 are detached through the conveyance way 5, it can prevent that the heat of the BEKU section 13 gets across to the resist coater 15, and can prevent being thermal influenced on the occasion of resist spreading processing.

[0015] The installation base 17 (spin chuck) in which vertical migration and a level revolution are free in the processing container 16 which is the processing room divided with the ambient atmosphere of the spreading processing section 10 as the above-mentioned resist coater 15 is shown in drawing 2 , The cup 18 which has exhaust-port 18a and effluent opening 18b at the pars basilaris ossis occipitalis while surrounding an outside [of this spin chuck 17], and lower part side, It comes to arrange the nozzle 19 which is the resist liquid supply means which applies resist liquid toward the front face of the wafer W held on a spin chuck 17 (supply), and nozzle 19A for rear-face washing of Wafer W.

[0016] Opening 15a for carrying in / taking out of Wafer W is prepared in one side face of the above-mentioned processing container 16, and this opening 15a is constituted so that it may be opened and closed by shutter 15b driven by driving means, such as a cylinder which is not illustrated. Moreover, rise and fall of a spin chuck 17 and revolution actuator 17a are arranged in the lower part side of the processing container 16. Furthermore, desiccation air induction inlet 16a is prepared in the head-lining section of the processing container 16, ULPA filter 50 is arranged in this desiccation air induction inlet 16a, and the dry air supplied by the desiccation air supply device 60 later mentioned by this ULPA filter 50 is defecated.

[0017] The above-mentioned desiccation air supply device 60 consists of a blower fan 63 arranged in the free passage way 62 which opens desiccation air induction inlet 16a and a duct 61 for free passage, a duct 61 and the desiccation air supply way 64 which is open for free passage in the source of air supply (not shown), and the dehumidifier 65 (dehumidification means) and temperature controller 66 (temperature control means) which are interposed in this desiccation air supply way 64.

[0018] Thus, it is set by the temperature controller 66 to predetermined temperature (about 23 degrees C), for example, a room temperature, and the air which flows the desiccation air supply way 64 by constituting flows in a duct 61, and is defecated by ULPA filter 50, and is supplied in the processing container 16 while it is controlled by the dehumidifier 65 by predetermined humidity, for example, 40% - 20%. The dry air supplied in the processing container 16 is compulsorily exhausted by the exhauster which was interposed in exhaust pipe 18c which is open for free passage to exhaust-port 18a of a cup 18 and which is not illustrated. Therefore, the inside of the processing container 16 is maintained by predetermined temperature, for example, about 23 degrees C, and predetermined humidity, for example, 40% - 20%, while it serves as positive pressure to the ambient atmosphere of parts other than resist coater 15 in the exterior 10, i.e., the spreading processing section.

[0019] On the other hand, in the above-mentioned development section 20, the side edge of the conveyance way 5 of the conveyance device 6 is met, and the two BEKU sections 21 (2nd heat treatment section) for carrying out chemical sensitization of the resist film after exposure to a side adjoin a single tier, and are arranged. Moreover, the development section which counters with the BEKU section 21 and carries out revolution spreading of the number 22, for example, the two development sections, for example, the developer, adjoins, and is arranged at the another side side of the conveyance way 5. Thus, by carrying out opposite arrangement, where the BEKU section 21 and the development section 22 are detached through the conveyance way 5, it can prevent that the heat of the BEKU section 21 gets across to the development section 22, and can prevent being thermal influenced on the occasion of a development.

[0020] Moreover, the above-mentioned aligner 40 is connected [section / 20 / above-mentioned / development] through interface section 30A possessing installation base 31A for

carrier delivery for delivering Wafer W, and the wafer installation base 41 and the Mitsuteru gunner stage (not shown) are established in this aligner 40. Moreover, the cassette 43 which holds the mask member M arranged in the top face of the wafer W laid on the wafer installation base 41 in the 1 side of this aligner 40 is arranged, and the mask member conveyance arm 42 which delivers the mask member M between this cassette 43 and the wafer installation base 41 is formed free [X, the direction of Y, a Z direction, and a revolution (theta)]. Moreover, the wafer conveyance arm 44 which delivers Wafer W between interface section 30A arranged between this aligner 40 and the development section 20 is formed in the aligner 40 free [X, the direction of Y, a Z direction, and a revolution (theta)].

[0021] Next, down stream processing of the wafer W in resist liquid spreading and the development system constituted as mentioned above is explained with reference to the flow chart of drawing 1 and drawing 3 , and drawing 4 .

[0022] First, the unsettled wafer W arranged at the cassette station 4 is received from cassette 1a with the pincettes 2 for conveyance, it conveys on the installation base 3 for carrier delivery, and center position doubling of Wafer W is performed. Next, after conveying in the brush washing section 11, performing brush washing, conveying in the jet backwashing-by-water section 14 and performing jet backwashing by water, hydrophobing processing for improving the adhesion of Wafer W and a resist is performed, conveying and heating to adhesion section 12a.

[0023] The wafer W by which hydrophobing processing was carried out is conveyed in the processing container 16 of the resist coater 15, after being cooled in cooling section 12b, and after the wafer conveyance arm 7 retreats and the inside of closing and the processing container 16 is maintained for shutter 15b by predetermined temperature (about 23 degrees C) and predetermined humidity, for example, 40% - 20%, spreading of resist liquid is performed to a front face. As the spreading process of this resist liquid is shown in drawing 4 , first, Wafer W rotates for example, in 1300rpm, a nozzle 19 is moved above Wafer W by the spin chuck 17 in this condition (nozzle transit time: about 1 sec), and resist liquid is applied after that from a nozzle 19 (spreading time amount: about 5 sec(s)). (supply) After resist liquid is applied, Wafer W is high-speed revolution, for example, 2000rpm, - 3000rpm, rotates between predetermined time, for example, 15sec(s) - 25sec, and predetermined thickness, for example, the 12000A resist film, is formed in a wafer W front face. Then, a revolution of Wafer W is slowed down by for example, 1600rpm, and in order to remove the resist liquid adhering to the rear face of Wafer W, a penetrant remover, for example, thinner, is breathed out between predetermined time, for example, 5sec(s), toward the rear face of Wafer W from nozzle 19for rear-face washing A. Then, it rotates for example, between 5sec(s) by high-speed revolution, for example, 2000rpm, again, thinner is shaken off, and a resist spreading process completes Wafer W.

[0024] In addition, in applying the antireflection film, after performing and baking antireflection-film spreading on the front face of Wafer W, spreading of resist liquid is performed. Thus, the BEKU section 13 is conveyed and BEKU again the wafer W with which spreading of resist liquid was performed, and the solvent in the resist film evaporates.

[0025] As mentioned above, since the desiccation air supply device 60 is formed in the spreading processing section 10 auxiliary, and it is processed by the wafer W processed within the processing container 16. [of predetermined temperature, for example, 23 degrees C, and predetermined humidity, for example, 40% - 20% of ambient atmosphere,] Therefore, volatilization of the solvent in resist liquid is promoted, and the resist film can be formed in homogeneity where the rotational speed of the part spin chuck 17 and Wafer W is raised.

[0026] After the wafer W with which the above-mentioned spreading processing was performed was conveyed on the installation base 31 for carrier delivery of the interface section 30, and having been received by the wafer conveyance arm 7 of the development section 20, being conveyed by installation base 31of interface section 30A A and carrying out alignment to it, It is conveyed on the installation base 41, and the light from the light source is irradiated through the mask member M, cutback projection is carried out by the conveyance arm 43 of an aligner 40, and a predetermined pattern is exposed. And after BEKU [the wafer W by which exposure processing was carried out / the wafer conveyance arm 7 / the BEKU section 21 of the development section 20 / conveyed and] through interface section 30A, it is conveyed by the

development section 22 and a development is performed. Thus, postbake of the wafer W by which the development was carried out is again conveyed and carried out to the BEKU section 21, and pattern reinforcement is strengthened.
[0027] After the wafer W with which development was given as mentioned above is conveyed on the installation base 3 for carrier delivery of the cassette station 4, it is conveyed by cassette 1b which is received with the pincettes 2 for conveyance and holds the wafer [finishing / processing] W, and processing completes it.
[0028] In addition, although the above-mentioned operation gestalt explained the case where the processor concerning this invention was applied to spreading and the development system of a semi-conductor wafer, resist liquid is applied to processed objects, such as LCD substrates other than a semi-conductor wafer, and exposure and also when carrying out a development, of course, it can apply.
[0029]
[Example] Next, the example of an experiment for investigating the optimum state of the processing ambient atmosphere in the above-mentioned processing container 16, i.e., temperature, and humidity is explained. When the ambient atmosphere in the above-mentioned processing container 16, i.e., the temperature in the processing container 16, was changed with 21 degrees C, 22 degrees C, 23 degrees C, 24 degrees C, and 25 degrees C and the homogeneity of the resist thickness of the front face of Wafer W was investigated in the state of 40% of humidity, the result as shown in drawing 5 was obtained, and it turned out that resist thickness becomes [the condition of being 23 degrees C] homogeneity. Moreover, temperature in the processing container 16 was made into 23 degrees C, and when humidity was changed to 80%, 40%, and 20% and the relation between resist thickness and thickness formation time amount was investigated, the result as shown in drawing 6 was obtained. Furthermore, the place which made temperature in the processing container 16 23 degrees C, changed the humidity in the case of forming resist thickness in 12200A to 80% - 20%, and investigated the relation between thickness stability swing end time amount and humidity, As opposed to 25sec(s) and the thickness stability swing end time amount in the case of 60% of humidity of the thickness stability swing end time amount in the case of a result as shown in drawing 7 being obtained, and being 80% of humidity being 19sec(s) 16sec(s) and the thickness stability swing end time amount in the case of 20% of humidity of the thickness stability swing end time amount in the case of 40% of humidity are 13sec(s). When the time amount of 9sec(s) was able to be shortened in the case of 40% of humidity and it was 20% of humidity compared with that of 80% of humidity, the time amount of 12sec(s) was able to be shortened. In addition, the rate of flow of the air supplied in the processing container 16 presupposed that it is fixed at 0.3 m/sec. Moreover, it is predicted that the thickness stability swing end time amount at the time of making humidity 20% or less becomes still shorter.
[0030] Therefore, while being able to shorten resist spreading time amount by making temperature in the processing container 16 into 23 degrees C, and setting up the humidity in the processing container 16 to 40% or less, equalization of the resist film can be attained.
[0031]
[Effect of the Invention] While being able to shorten the volatilization time amount of the solvent in resist liquid according to the resist coater of this invention since the processing interior of a room is certainly maintainable in a low humidity ambient atmosphere as explained above, the time amount which formation of the resist film takes can be shortened. Moreover, since resist spreading processing can be performed according to the exposure processing time after a resist spreading process, the processing time of the whole process can be shortened and improvement in a throughput can be aimed at.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to a resist coater.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Processing liquid, for example, photoresist liquid, is applied to semi-conductor wafers (a wafer is told to below), such as a processed object, for example, a silicon substrate etc., a circuit pattern etc. is reduced to the production process of a semiconductor device using a photograph technique, the photoresist film is exposed to it, and there is a series of down stream processing which carries out the development of this in it. This down stream processing is called photolithography.
[0003] This down stream processing is a very important process in high integration of a semiconductor device, and in this process, in order to form the resist film in the front face of a processed object, for example, a wafer, at homogeneity, careful caution and time amount are spent. After this resist spreading process moves a nozzle and applies resist liquid to a wafer front face from a nozzle while holding the wafer conveyed by resist equipment on an installation base and carrying out a predetermined revolution, it carries out the high-speed revolution of the wafer, diffuses resist liquid, and forms the resist film of predetermined thickness in a wafer front face. Then, the slowdown revolution of the revolution of a wafer is carried out, after breathing out, the penetrant remover, for example, the thinner, from which the resist liquid which turned to the rear face of a wafer is removed, the high-speed revolution of the wafer is carried out again, and swing OFF completes processing for thinner.
[0004] the above-mentioned resist spreading process -- setting -- the resist film -- predetermined thickness -- and since a revolution of a wafer cannot be made extremely high-speed relating with the time amount to which the solvent in resist liquid volatilizes, and the rotational frequency of a wafer in order to form in homogeneity, much time amount is spent.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] While being able to shorten the volatilization time amount of the solvent in resist liquid according to the resist coater of this invention since the processing interior of a room is certainly maintainable in a low humidity ambient atmosphere as explained above, the time amount which formation of the resist film takes can be shortened. Moreover, since resist spreading processing can be performed according to the exposure processing time after a resist spreading process, the processing time of the whole process can be shortened and improvement in a throughput can be aimed at.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when the resist spreading process took time amount, lost time arose in exposure processing of degree process, and there was a problem of causing lowering of productivity.
[0006] This invention was made in view of the above-mentioned situation, and aims at offering the resist coater which shortens the formation time amount of the resist film and enabled it to aim at improvement in a throughput by promoting volatilization of the solvent in resist liquid.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned object, a resist coater according to claim 1 In the resist coater which is made to rotate a processed object and forms the resist film in a processed body surface while supplying resist liquid to the front face of a processed object While carrying out partition formation of the processing room of the above-mentioned processed object in the above-mentioned equipment with the exterior, introducing dry air into the processing interior of a room and making the processing interior of a room into a positive pressure ambient atmosphere to the exterior, it is characterized by considering as a low humidity ambient atmosphere.
[0008] While a resist coater according to claim 2 supplies resist liquid to the front face of a processed object In the resist coater which is made to rotate a processed object and forms the resist film in a processed body surface The installation base which holds the above-mentioned processed object horizontally pivotable, and a resist liquid supply means to supply resist liquid to a processed body surface It is characterized by the thing arrange in the exterior and the processing interior of a room divided, arrange a desiccation air induction inlet above the above-mentioned installation base in the above-mentioned processing room, and it comes to arrange a dehumidification means and a temperature control means in the desiccation air supply way which is open for free passage to the above-mentioned desiccation air induction inlet.
[0009] It is better to set up humidity to 40% or less, while making temperature of the processing interior of a room it being [direction] desirable (claim 3) still more desirable, and setting up the humidity of the above-mentioned processing interior of a room to 40% or less into 23 degrees C in this invention (claim 4).
[0010] Since the processing interior of a room is certainly maintainable in a low humidity ambient atmosphere by making it a low humidity ambient atmosphere while according to this invention carrying out partition formation of the processing room of the processed object in equipment with the exterior, introducing dry air into the processing interior of a room and making the processing interior of a room into a positive pressure ambient atmosphere to the exterior, while being able to shorten the volatilization time amount of the solvent in resist liquid, the time amount which formation of the resist film takes can be shortened. Moreover, since resist spreading processing can be performed according to the exposure processing time after a resist spreading process, while being able to shorten the processing time of the whole process, improvement in a throughput can be aimed at.
[0011]
[Embodiment of the Invention] Next, the gestalt of implementation of this invention is explained to a detail based on an accompanying drawing. This operation gestalt explains the case where the resist coater of this invention is applied to resist liquid spreading and the development system to a semi-conductor wafer.
[0012] The above-mentioned resist liquid spreading and development system arrange 1st cassette 1a which holds the unsettled processed object (a wafer is told to below) W, for example, a semi-conductor wafer, and 2nd cassette 1b which holds the wafer [finishing / processing] W in a predetermined location, as shown in drawing 1 . The pincette 2 for conveyance of the wafer W which performs taking out or carrying in of Wafer W among these

cassettes 1a and 1b, and the cassette station 4 possessing the installation base 3 for carrier delivery, The spreading processing section 10 which is adjoined and arranged in this cassette station 4, and forms the resist film in the front face of Wafer W, The development section 20 which carries out the development of the wafer W by which was arranged through the interface section 30 between this spreading processing section 10, and exposure processing was carried out, The body consists of aligners 40 (exposure processing section) which irradiate ultraviolet radiation from the light source through the predetermined mask member M at the wafer W by which was arranged through interface section 30A between this development section 20, and spreading processing was carried out, and expose a predetermined circuit pattern on the resist film.

[0013] The straight-line-like conveyance way 5 is laid by the center section of the above-mentioned spreading processing section 10 and the development section 20, respectively, and this conveyance way 5 is established in the movable conveyance device 6 in it. The wafer conveyance arm 7 which can move to this conveyance device 6 to X, the direction of Y, and a perpendicular direction (Z direction) in the level surface, and can be rotated freely (theta) is formed.

[0014] In the above-mentioned spreading processing section 10, while meets the side edge of the conveyance way 5 of the conveyance device 6, and the adhesion section / cooling section 12 which accumulated and prepared adhesion section 12a and cooling section 12b which perform the brush washing section 11 and hydrophobing down stream processing, and the BEKU section 13 (1st heat treatment section) adjoin a side at a single tier, and it is arranged. Moreover, the resist coater 15 of this invention that carries out spin coating of the jet backwashing-by-water section 14 and the number (it is specifically usual resist liquid and the resist liquid for acid resisting), for example, the two resist liquid, adjoins a single tier, and is arranged, and opposite arrangement of the resist coater 15 and the BEKU section 13 is carried out through the conveyance way 5 at the another side side of the conveyance way 5. Thus, by carrying out opposite arrangement, where the BEKU section 13 and the resist coater 15 are detached through the conveyance way 5, it can prevent that the heat of the BEKU section 13 gets across to the resist coater 15, and can prevent being thermal influenced on the occasion of resist spreading processing.

[0015] The installation base 17 (spin chuck) in which vertical migration and a level revolution are free in the processing container 16 which is the processing room divided with the ambient atmosphere of the spreading processing section 10 as the above-mentioned resist coater 15 is shown in drawing 2 , The cup 18 which has exhaust-port 18a and effluent opening 18b at the pars basilaris ossis occipitalis while surrounding an outside [of this spin chuck 17], and lower part side, It comes to arrange the nozzle 19 which is the resist liquid supply means which applies resist liquid toward the front face of the wafer W held on a spin chuck 17 (supply), and nozzle 19A for rear-face washing of Wafer W.

[0016] Opening 15a for carrying in / taking out of Wafer W is prepared in one side face of the above-mentioned processing container 16, and this opening 15a is constituted so that it may be opened and closed by shutter 15b driven by driving means, such as a cylinder which is not illustrated. Moreover, rise and fall of a spin chuck 17 and revolution actuator 17a are arranged in the lower part side of the processing container 16. Furthermore, desiccation air induction inlet 16a is prepared in the head-lining section of the processing container 16, ULPA filter 50 is arranged in this desiccation air induction inlet 16a, and the dry air supplied by the desiccation air supply device 60 later mentioned by this ULPA filter 50 is defecated.

[0017] The above-mentioned desiccation air supply device 60 is the dehumidifier 65 interposed in the blower fan 63 arranged in the free passage way 62 which opens desiccation air induction inlet 16a and a duct 61 for free passage, a duct 61 and the desiccation air supply way 64 which is open for free passage in the source of air supply (not shown), and this desiccation air supply way 64.

[Translation done.]

EXAMPLE

[Example] Next, the example of an experiment for investigating the optimum state of the processing ambient atmosphere in the above-mentioned processing container 16, i.e., temperature, and humidity is explained. When the ambient atmosphere in the above-mentioned processing container 16, i.e., the temperature in the processing container 16, was changed with 21 degrees C, 22 degrees C, 23 degrees C, 24 degrees C, and 25 degrees C and the homogeneity of the resist thickness of the front face of Wafer W was investigated in the state of 40% of humidity, the result as shown in drawing 5 was obtained, and it turned out that resist thickness becomes [the condition of being 23 degrees C] homogeneity. Moreover, temperature in the processing container 16 was made into 23 degrees C, and when humidity was changed to 80%, 40%, and 20% and the relation between resist thickness and thickness formation time amount was investigated, the result as shown in drawing 6 was obtained. Furthermore, the place which made temperature in the processing container 16 23 degrees C, changed the humidity in the case of forming resist thickness in 12200A to 80% - 20%, and investigated the relation between thickness stability swing end time amount and humidity, As opposed to 25sec(s) and the thickness stability swing end time amount in the case of 60% of humidity of the thickness stability swing end time amount in the case of a result as shown in drawing 7 being obtained, and being 80% of humidity being 19sec(s) 16sec(s) and the thickness stability swing end time amount in the case of 20% of humidity of the thickness stability swing end time amount in the case of 40% of humidity are 13sec(s). When the time amount of 9sec(s) was able to be shortened in the case of 40% of humidity and it was 20% of humidity compared with that of 80% of humidity, the time amount of 12sec(s) was able to be shortened. In addition, the rate of flow of the air supplied in the processing container 16 presupposed that it is fixed at 0.3 m/sec. Moreover, it is predicted that the thickness stability swing end time amount at the time of making humidity 20% or less becomes still shorter.
[0030] Therefore, while being able to shorten resist spreading time amount by making temperature in the processing container 16 into 23 degrees C, and setting up the humidity in the processing container 16 to 40% or less, equalization of the resist film can be attained.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline top view of an example possessing the resist coater of this invention of resist liquid spreading / development system of a semi-conductor wafer.
[Drawing 2] It is the outline sectional view of the resist coater of this invention.
[Drawing 3] It is a flow chart explaining FOTORISO down stream processing of a semi-conductor wafer.
[Drawing 4] It is a flow chart explaining the resist spreading process of a semi-conductor wafer.
[Drawing 5] It is the graph which shows the change condition of the resist thickness of the semi-conductor wafer front face at the time of changing processing ambient temperature.
[Drawing 6] It is the graph which shakes off with the resist thickness at the time of changing processing ambient atmosphere humidity, and shows relation with time amount.
[Drawing 7] It is the graph which shows the relation between the thickness stability swing end time amount at the time of fixing resist thickness, and humidity.
[Description of Notations]
W Semi-conductor wafer (processed object)
16 Processing Container (Processing Room)
16a Air induction inlet
17 Spin Chuck (Installation Base)
19 Nozzle (Resist Liquid Supply Means)
50 ULPA Filter
60 Desiccation Air Supply Device
64 Desiccation Air Supply Way
65 Dehumidifier (Dehumidification Means)
66 Temperature Controller (Temperature Control Means)

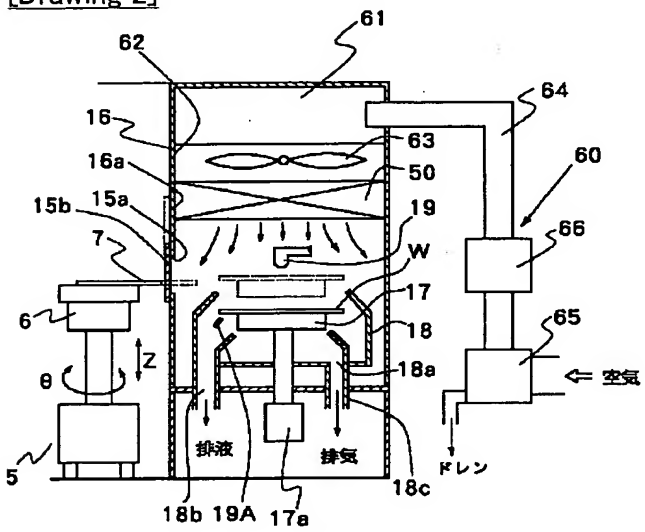
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

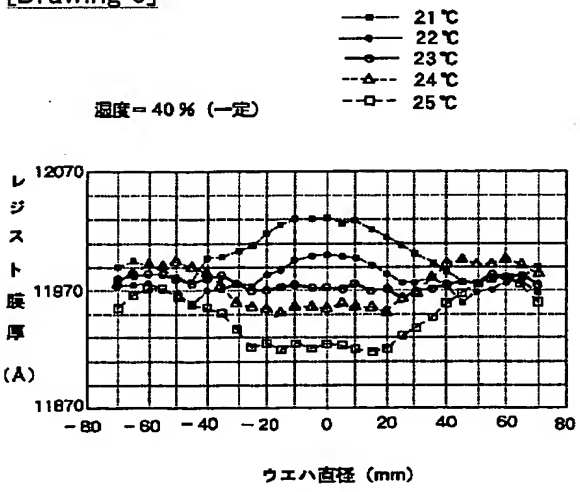
DRAWINGS

[Drawing 2]

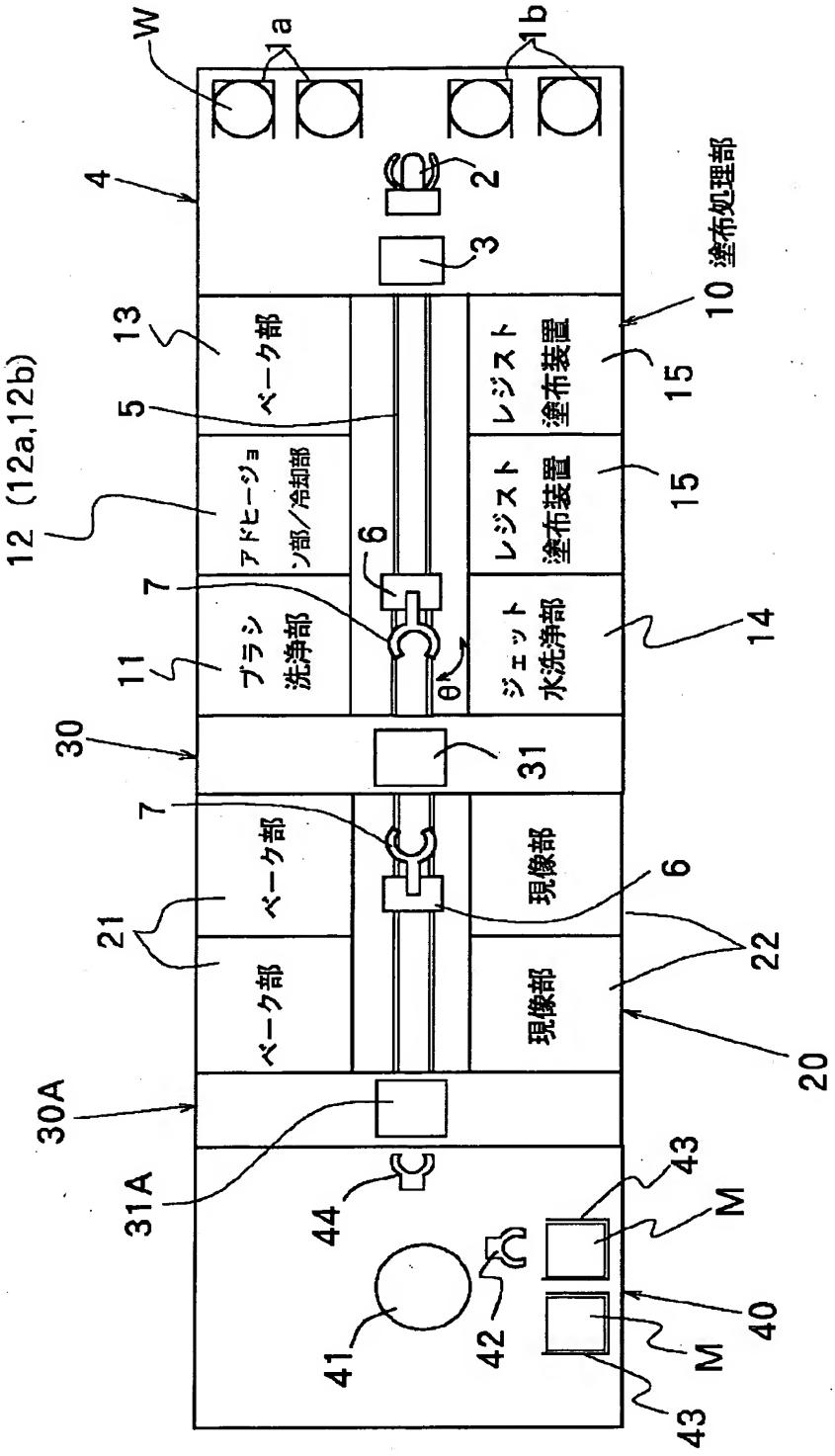


16：処理容器
16a：乾燥空気導入口
17：スピンチャック
19：レジスト液供給ノズル
50：ULPAフィルタ
60：乾燥空気供給機構
64：乾燥空気供給路
65：除湿器
66：温度コントローラ

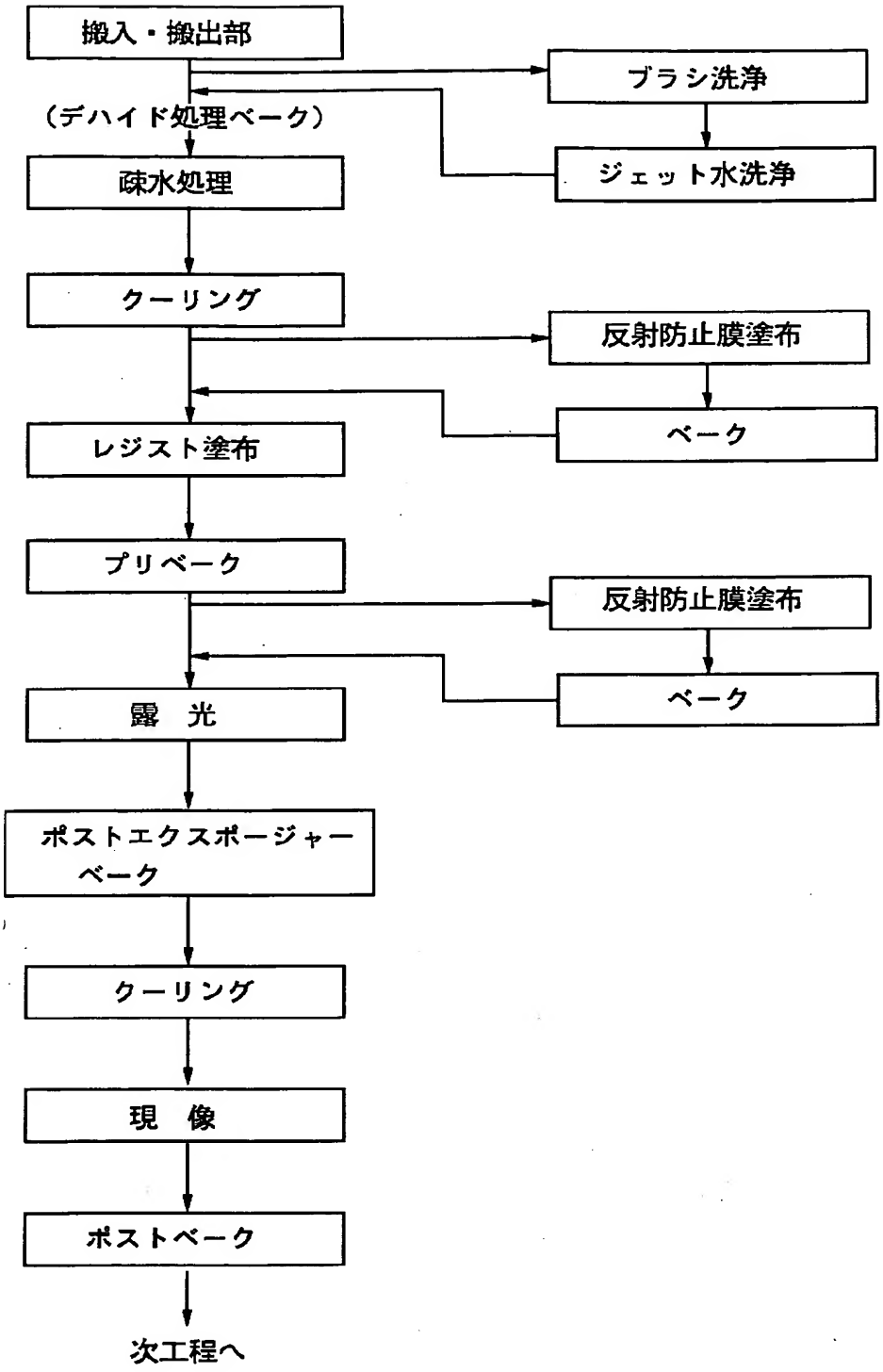
[Drawing 5]



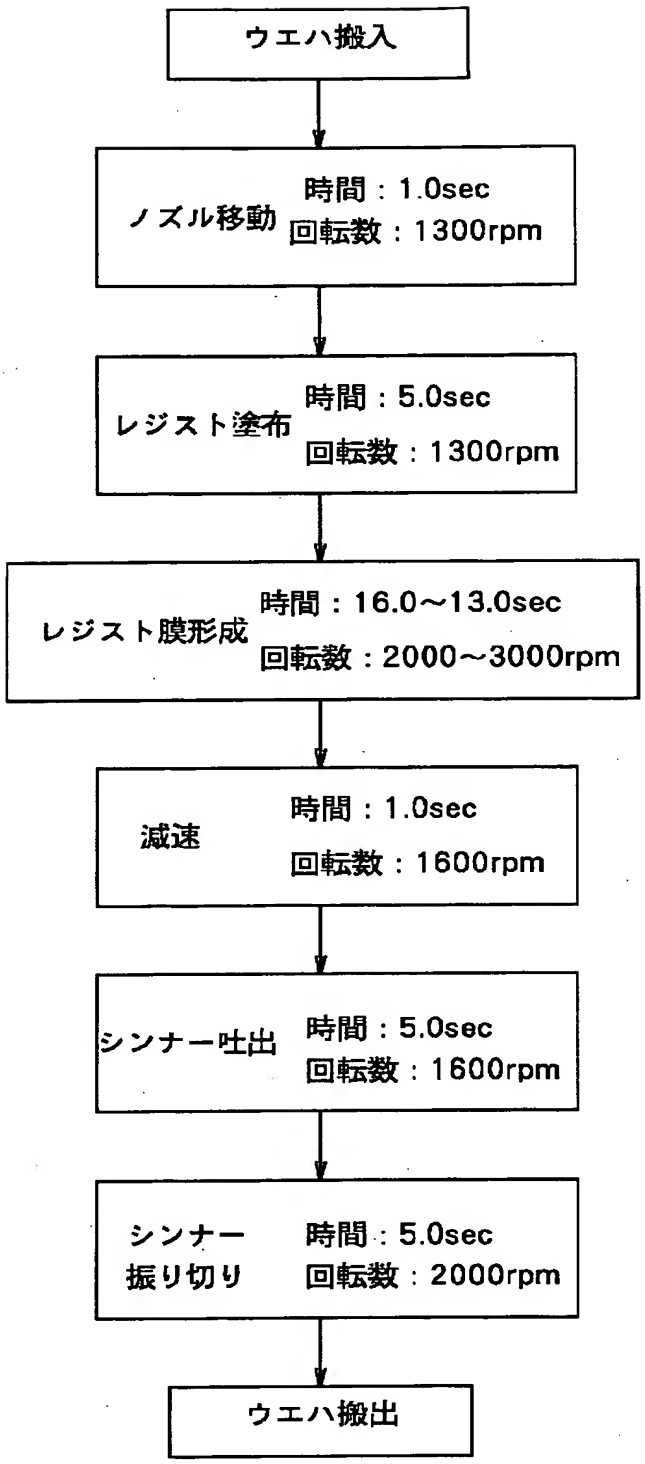
[Drawing 1]


W
1a
1b
2
3
4
5
6
7
10 塗布処理部
11
12 (12a,12b)
13
14
15
20
21
22
30
30A
31
31A
40
41
42
43
44
M
ベーク部
アドヒージョン部/冷却部
ブラシ洗浄部
レジスト塗布装置
ジェット水洗浄部
現像部
θ

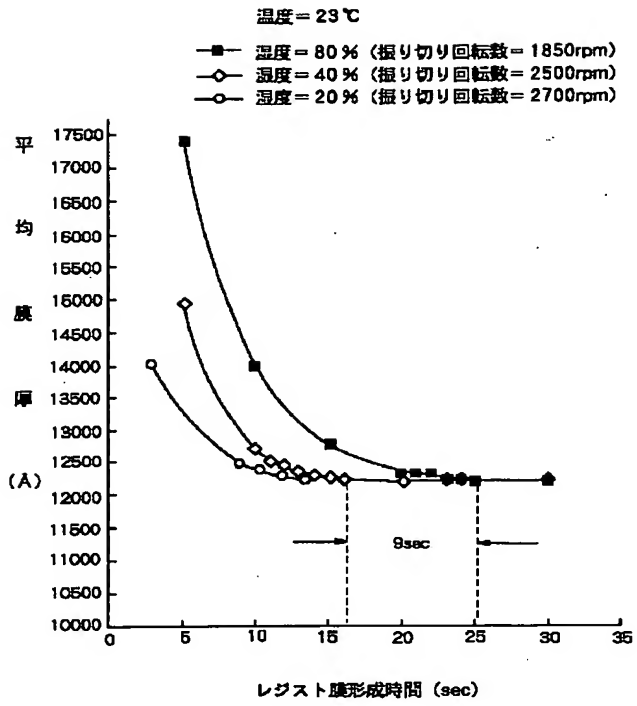
[Drawing 3]


搬入・搬出部
ブラシ洗浄
（デハイド処理ベーク）
ジェット水洗浄
疎水処理
クーリング
反射防止膜塗布
ベーク
レジスト塗布
プリベーク
反射防止膜塗布
ベーク
露　光
ポストエクスポージャー
ベーク
クーリング
現　像
ポストベーク
次工程へ

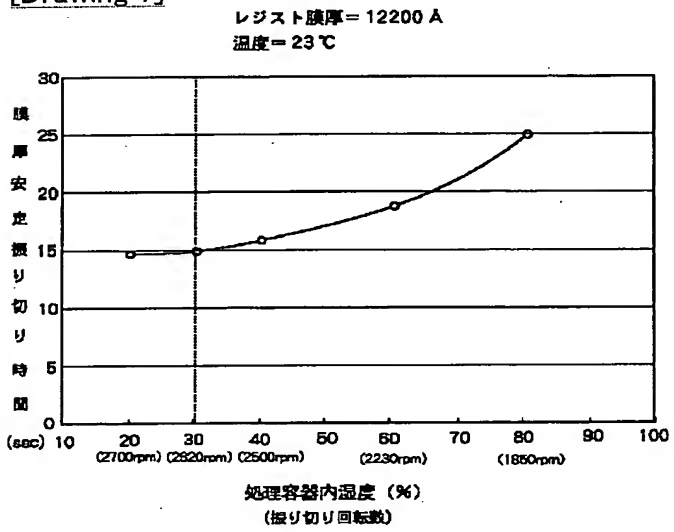
[Drawing 4]


ウエハ搬入
ノズル移動
時間：1.0sec
回転数：1300rpm
レジスト塗布
時間：5.0sec
回転数：1300rpm
レジスト膜形成
時間：16.0～13.0sec
回転数：2000～3000rpm
減速
時間：1.0sec
回転数：1600rpm
シンナー吐出
時間：5.0sec
回転数：1600rpm
シンナー
振り切り
時間：5.0sec
回転数：2000rpm
ウエハ搬出

[Drawing 6]



[Drawing 7]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（A）**　(11)特許出願公開番号

特開平9－205062

(43)公開日　平成９年(1997)８月５日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ｈ０１Ｌ　21/027			Ｈ０１Ｌ　21/30	５６４Ｄ	
Ｂ０５Ｃ　11/06			Ｂ０５Ｃ　11/06		
11/08			11/08		
Ｂ０５Ｄ　1/40			Ｂ０５Ｄ　1/40	Ａ	
Ｇ０３Ｆ　7/16	５０２		Ｇ０３Ｆ　7/16	５０２	

審査請求　未請求　請求項の数４　ＦＤ　（全　８　頁）

(21)出願番号　特願平8－31248

(22)出願日　平成８年(1996)１月26日

(71)出願人　000219967
東京エレクトロン株式会社
東京都港区赤坂５丁目３番６号

(72)発明者　青山　亨
山梨県韮崎市穂坂町三ツ沢650　東京エレクトロン九州株式会社山梨開発センター内

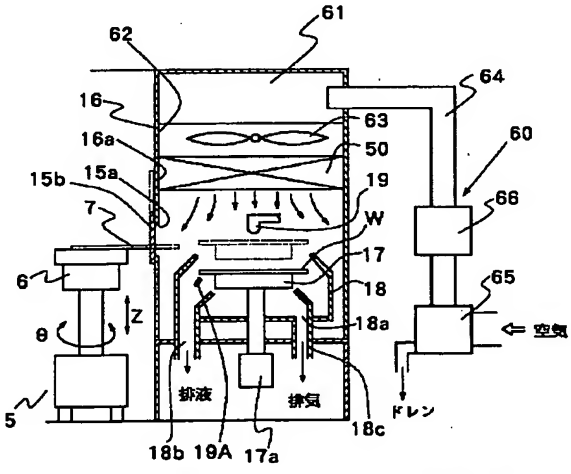
(74)代理人　弁理士　中本　菊彦

(54)【発明の名称】　レジスト塗布装置

(57)【要約】

【課題】　レジスト膜を均一にし、かつ、レジスト膜の形成時間を短縮してスループットの向上を図れるようにすること。

【解決手段】　半導体ウエハＷを水平回転可能に保持するスピンチャック１７と、半導体ウエハＷ表面にレジスト液を供給するレジスト液供給ノズル１９とを、外部と区画される処理容器１６内に配設する。処理容器１６におけるスピンチャック１７の上方に乾燥空気導入口１６ａを配設し、この乾燥空気導入口１６ａに連通する乾燥空気供給路６４に、除湿器６５及び温度コントローラ６６を配設する。これにより、処理容器１６内を外部に対して陽圧にすると共に、湿度を４０％以下に設定することができるので、レジスト液中の溶剤の揮発を促進してレジスト膜の形成時間を短縮し、スループットの向上を図ることができる。



16：処理容器　60：乾燥空気供給機構
16a：乾燥空気導入口　64：乾燥空気供給路
17：スピンチャック　65：除湿器
19：レジスト液供給ノズル　66：温度コントローラ
50：ULPAフィルタ

1

【特許請求の範囲】
【請求項１】　被処理体の表面にレジスト液を供給すると共に、被処理体を回転させて、被処理体表面にレジスト膜を形成するレジスト塗布装置において、
上記装置内の上記被処理体の処理室を外部と区画形成し、処理室内に乾燥空気を導入して、処理室内を外部に対して陽圧雰囲気にすると共に、低湿度雰囲気としたことを特徴とするレジスト塗布装置。
【請求項２】　被処理体の表面にレジスト液を供給すると共に、被処理体を回転させて、被処理体表面にレジスト膜を形成するレジスト塗布装置において、
上記被処理体を水平回転可能に保持する載置台と、被処理体表面にレジスト液を供給するレジスト液供給手段とを、外部と区画される処理室内に配設し、
上記処理室における上記載置台の上方に乾燥空気導入口を配設し、
上記乾燥空気導入口に連通する乾燥空気供給路に、除湿手段及び温度制御手段を配設してなる、ことを特徴とするレジスト塗布装置。
【請求項３】　上記処理室内の湿度を４０％以下に設定することを特徴とする請求項１又は２記載のレジスト塗布装置。
【請求項４】　上記処理室内の温度を２３℃とすると共に、湿度を４０％以下に設定することを特徴とする請求項１又は２記載のレジスト塗布装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明はレジスト塗布装置に関するものである。
【０００２】
【従来の技術】半導体デバイスの製造工程には、被処理体例えばシリコン基板等の半導体ウエハ（以下にウエハという）に処理液例えばフォトレジスト液を塗布し、フォト技術を用いて回路パターン等を縮小してフォトレジスト膜を露光し、これを現像処理する一連の処理工程がある。この処理工程をフォトリソグラフィという。
【０００３】この処理工程は、半導体デバイスの高集積化において極めて重要なプロセスであり、このプロセスにおいて、被処理体例えばウエハの表面にレジスト膜を均一に形成するために、細心の注意及び時間が費やされている。このレジスト塗布プロセスは、レジスト装置に搬送されたウエハを載置台にて保持して所定回転する間にノズルを移動し、ノズルからウエハ表面にレジスト液を塗布した後、ウエハを高速回転してレジスト液を拡散させ、ウエハ表面に所定の膜厚のレジスト膜を形成する。その後、ウエハの回転を減速回転して、ウエハの裏面に回り込んだレジスト液を除去する洗浄液例えばシンナーを吐出した後、再びウエハを高速回転し、シンナーを振り切って処理を完了する。
【０００４】上記レジスト塗布プロセスにおいて、レジスト膜を所定の膜厚にかつ均一に形成するには、レジスト液中の溶剤の揮発する時間とウエハの回転数とが関係し、ウエハの回転を極端に高速度にすることができないため、多くの時間が費やされている。

2

【０００５】
【発明が解決しようとする課題】しかしながら、レジスト塗布プロセスに時間を要すると、次工程の露光処理にロスタイムが生じ生産性の低下をきたすという問題があった。
【０００６】この発明は上記事情に鑑みなされたもので、レジスト液中の溶剤の揮発を促進することにより、レジスト膜の形成時間を短縮してスループットの向上を図れるようにしたレジスト塗布装置を提供することを目的とするものである。
【０００７】
【課題を解決するための手段】上記目的を達成するために、請求項１記載のレジスト塗布装置は、被処理体の表面にレジスト液を供給すると共に、被処理体を回転させて、被処理体表面にレジスト膜を形成するレジスト塗布装置において、上記装置内の上記被処理体の処理室を外部と区画形成し、処理室内に乾燥空気を導入して、処理室内を外部に対して陽圧雰囲気にすると共に、低湿度雰囲気としたことを特徴とする。
【０００８】請求項２記載のレジスト塗布装置は、被処理体の表面にレジスト液を供給すると共に、被処理体を回転させて、被処理体表面にレジスト膜を形成するレジスト塗布装置において、上記被処理体を水平回転可能に保持する載置台と、被処理体表面にレジスト液を供給するレジスト液供給手段とを、外部と区画される処理室内に配設し、上記処理室における上記載置台の上方に乾燥空気導入口を配設し、上記乾燥空気導入口に連通する乾燥空気供給路に、除湿手段及び温度制御手段を配設してなる、ことを特徴とする。
【０００９】この発明において、上記処理室内の湿度を４０％以下に設定する方が好ましく（請求項３）、更に好ましくは処理室内の温度を２３℃とすると共に、湿度を４０％以下に設定する方がよい（請求項４）。
【００１０】この発明によれば、装置内の被処理体の処理室を外部と区画形成し、処理室内に乾燥空気を導入して、処理室内を外部に対して陽圧雰囲気にすると共に、低湿度雰囲気にすることにより、処理室内を確実に低湿度雰囲気に維持することができるので、レジスト液中の溶剤の揮発時間を短縮することができると共に、レジスト膜の形成に要する時間を短縮させることができる。また、レジスト塗布工程以後の露光処理時間に合せてレジスト塗布処理を行うことができるので、プロセス全体の処理時間を短縮することができると共に、スループットの向上を図ることができる。
【００１１】
【発明の実施の形態】次に、この発明の実施の形態を添

付図面に基いて詳細に説明する。この実施形態では、この発明のレジスト塗布装置を半導体ウエハへのレジスト液塗布・現像処理システムに適用した場合について説明する。

【００１２】上記レジスト液塗布・現像処理システムは、図１に示すように、未処理の被処理体例えば半導体ウエハＷ（以下にウエハという）を収容する第１のカセット１ａと処理済みのウエハＷを収容する第２のカセット１ｂを所定位置に配置し、これらカセット１ａ及び１ｂとの間でウエハＷの搬出又は搬入を行うウエハＷの搬送用ピンセット２と受渡し用載置台３を具備するカセットステーション４と、このカセットステーション４に隣接して配設されてウエハＷの表面にレジスト膜を形成する塗布処理部１０と、この塗布処理部１０との間にインター・フェース部３０を介して配設されて露光処理されたウエハＷを現像処理する現像処理部２０と、この現像処理部２０との間にインター・フェース部３０Ａを介して配設されて塗布処理されたウエハＷに所定のマスク部材Ｍを介して光源から紫外光を照射してレジスト膜に所定の回路パターンを露光する露光装置４０（露光処理部）とで主要部が構成されている。

【００１３】上記塗布処理部１０と現像処理部２０の中央部には、それぞれ直線状の搬送路５が敷設されており、この搬送路５を移動可能な搬送機構６が設けられている。この搬送機構６には水平面内でＸ，Ｙ方向及び垂直方向（Ｚ方向）に移動し、かつ回転（θ）自在なウエハ搬送アーム７が設けられている。

【００１４】上記塗布処理部１０において、搬送機構６の搬送路５の側縁に沿う一方の側には、ブラシ洗浄部１１，疎水化処理工程を実行するアドヒージョン部１２ａと冷却部１２ｂとを積み重ねて設けたアドヒージョン部／冷却部１２及びベーク部１３（第１の熱処理部）が一列に隣接して配置されている。また、搬送路５の他方の側には、ジェット水洗浄部１４と個数例えば２個のレジスト液（具体的には通常のレジスト液と反射防止用レジスト液）をスピンコーティングするこの発明のレジスト塗布装置１５が一列に隣接して配置され、レジスト塗布装置１５とベーク部１３とが搬送路５を介して対向配置されている。このように搬送路５を介してベーク部１３とレジスト塗布装置１５とを離した状態で対向配置することにより、ベーク部１３の熱がレジスト塗布装置１５に伝わるのを防止することができ、レジスト塗布処理に際して熱的影響を受けるのを防止することができる。

【００１５】上記レジスト塗布装置１５は、図２に示すように、塗布処理部１０の雰囲気と区画される処理室である処理容器１６内に、垂直移動及び水平回転自在な載置台１７（スピンチャック）と、このスピンチャック１７の外側及び下部側を包囲すると共に底部に排気口１８ａと排液口１８ｂを有するカップ１８と、スピンチャック１７上に保持されるウエハＷの表面に向ってレジスト液を塗布（供給）するレジスト液供給手段であるノズル１９と、ウエハＷの裏面洗浄用ノズル１９Ａとを配設してなる。

【００１６】上記処理容器１６の一側面にはウエハＷの搬入・搬出用の開口１５ａが設けられており、この開口１５ａは、図示しないシリンダ等の駆動手段によって駆動するシャッタ１５ｂによって開閉されるように構成されている。また、処理容器１６の下部側には、スピンチャック１７の昇降及び回転駆動部１７ａが配設されている。更に、処理容器１６の天井部には乾燥空気導入口１６ａが設けられ、この乾燥空気導入口１６ａ内にＵＬＰＡフィルタ５０が配置されており、このＵＬＰＡフィルタ５０によって後述する乾燥空気供給機構６０により供給される乾燥空気が清浄化されるようになっている。

【００１７】上記乾燥空気供給機構６０は、乾燥空気導入口１６ａとダクト６１とを連通する連通路６２内に配設される送風ファン６３と、ダクト６１と空気供給源（図示せず）に連通する乾燥空気供給路６４と、この乾燥空気供給路６４に介設される除湿器６５（除湿手段）及び温度コントローラ６６（温度制御手段）とで構成されている。

【００１８】このように構成することにより、乾燥空気供給路６４を流れる空気は除湿器６５によって所定の湿度例えば４０％～２０％に制御されると共に、温度コントローラ６６によって所定温度例えば室温（約２３℃）に設定されてダクト６１内に流れ、そして、ＵＬＰＡフィルタ５０によって清浄化されて処理容器１６内に供給される。処理容器１６内に供給された乾燥空気はカップ１８の排気口１８ａに連通する排気管１８ｃに介設された図示しない排気装置によって強制的に排気される。したがって、処理容器１６内は外部すなわち塗布処理部１０内のレジスト塗布装置１５以外の部分の雰囲気に対して陽圧となると共に、所定の温度例えば約２３℃及び所定の湿度例えば４０％～２０％に維持される。

【００１９】一方、上記現像処理部２０において、搬送機構６の搬送路５の側縁に沿う一方の側には、露光後のレジスト膜を化学増感するための２個のベーク部２１（第２の熱処理部）が一列に隣接して配置されている。また、搬送路５の他方の側には、ベーク部２１と対向して個数例えば２個の現像部２２例えば現像液を回転塗布する現像処理部が隣接して配置されている。このように、ベーク部２１と現像部２２とを搬送路５を介して離した状態で対向配置することにより、ベーク部２１の熱が現像部２２に伝わるのを防止することができ、現像処理に際して熱的影響を受けるのを防止することができる。

【００２０】また、上記露光装置４０は、ウエハＷを受け渡しするための受渡し用載置台３１Ａを具備するインター・フェース部３０Ａを介して上記現像処理部２０に連接されており、この露光装置４０には、ウエハ載置台

４１と光照射手段（図示せず）が設けられている。また、この露光装置４０の一側にはウエハ載置台４１上に載置されたウエハＷの上面に配設されるマスク部材Ｍを収容するカセット４３が配置され、このカセット４３とウエハ載置台４１との間でマスク部材Ｍを受け渡しするマスク部材搬送アーム４２がＸ，Ｙ方向、Ｚ方向及び回転（θ）自在に設けられている。また、露光装置４０には、この露光装置４０と現像処理部２０との間に配置されたインター・フェース部３０Ａとの間でウエハＷの受渡しを行うウエハ搬送アーム４４がＸ，Ｙ方向、Ｚ方向及び回転（θ）自在に設けられている。

【００２１】次に、上記のように構成されるレジスト液塗布・現像処理システムにおけるウエハＷの処理工程について、図１及び図３と図４のフローチャートを参照して説明する。

【００２２】まず、カセットステーション４に配置された未処理のウエハＷを搬送用ピンセット２によってカセット１ａから受け取って受渡し用載置台３に搬送し、ウエハＷの中心位置合わせを行う。次に、ブラシ洗浄部１１に搬送してブラシ洗浄を行い、ジェット水洗浄部１４に搬送してジェット水洗浄を行った後、アドヒージョン部１２ａに搬送して加熱しつつウエハＷとレジストとの密着性を改善するための疎水化処理を施す。

【００２３】疎水化処理されたウエハＷは冷却部１２ｂにて冷却された後、レジスト塗布装置１５の処理容器１６内に搬送され、ウエハ搬送アーム７が後退してシャッタ１５ｂが閉じ、処理容器１６内が所定温度（約２３℃）及び所定湿度例えば４０％～２０％に維持された後、表面にレジスト液の塗布が施される。このレジスト液の塗布工程は、図４に示すように、まず、スピンチャック１７によってウエハＷが例えば１３００ｒｐｍにて回転され、この状態でノズル１９がウエハＷの上方に移動され（ノズル移動時間：約１ｓｅｃ）、その後、ノズル１９からレジスト液が塗布（供給）される（塗布時間：約５ｓｅｃ）。レジスト液が塗布された後、ウエハＷは高速回転例えば２０００ｒｐｍ～３０００ｒｐｍで、所定時間例えば１５ｓｅｃ～２５ｓｅｃ間回転されて、ウエハＷ表面に所定の膜厚例えば１２０００Åのレジスト膜が形成される。その後、ウエハＷの回転が例えば１６００ｒｐｍに減速され、ウエハＷの裏面に付着するレジスト液を除去するために、裏面洗浄用ノズル１９Ａからウエハの裏面に向って洗浄液例えばシンナーが所定時間例えば５ｓｅｃ間吐出される。その後、ウエハＷは再び高速回転例えば２０００ｒｐｍで例えば５ｓｅｃ間回転されてシンナーが振り切られてレジスト塗布工程が完了する。

【００２４】なお、反射防止膜を塗布する場合には、ウエハＷの表面に反射防止膜塗布を施し、ベーキングした後、レジスト液の塗布が施される。このようにしてレジスト液の塗布が施されたウエハＷは再びベーク部１３に搬送されてベークされてレジスト膜中の溶剤が蒸発される。

【００２５】上記のように、塗布処理部１０には補助的に乾燥空気供給機構６０が設けられているので、処理容器１６内で処理されるウエハＷは所定の温度例えば２３℃及び所定の湿度例えば４０％～２０％の雰囲気下におかれて処理される。したがって、レジスト液中の溶剤の揮発が促進され、その分スピンチャック１７及びウエハＷの回転速度を高めた状態でレジスト膜を均一に形成することができる。

【００２６】上記塗布処理が施されたウエハＷは、インター・フェース部３０の受渡し用載置台３１に搬送されて現像処理部２０のウエハ搬送アーム７に受け取られてインター・フェース部３０Ａの載置台３１Ａに搬送されて位置合わせされた後、露光装置４０の搬送アーム４３によって載置台４１上に搬送され、マスク部材Ｍを介して光源からの光が照射されて所定のパターンが縮小投影されて露光される。そして、露光処理されたウエハＷはインター・フェース部３０Ａを介してウエハ搬送アーム７によって現像処理部２０のベーク部２１に搬送されてベークされた後、現像部２２に搬送されて現像処理が施される。このようにして現像処理されたウエハＷは再びベーク部２１に搬送されてポストベークされてパターン強度が強化される。

【００２７】上記のようにして現像が施されたウエハＷは、カセットステーション４の受渡し用載置台３に搬送された後、搬送用ピンセット２によって受け取られて処理済みのウエハＷを収容するカセット１ｂに搬送されて処理が完了する。

【００２８】なお、上記実施形態では、この発明に係る処理装置を半導体ウエハの塗布・現像処理システムに適用した場合について説明したが、半導体ウエハ以外のＬＣＤ基板等の被処理体にレジスト液を塗布し、露光及び現像処理する場合にも適用できることは勿論である。

【００２９】

【実施例】次に、上記処理容器１６内の処理雰囲気すなわち温度及び湿度の最適状態を調べるための実験例について説明する。上記処理容器１６内の雰囲気すなわち処理容器１６内の温度を例えば２１℃，２２℃，２３℃，２４℃及び２５℃と変化させて、湿度４０％の状態でウエハＷの表面のレジスト膜厚の均一性を調べたところ、図５に示すような結果が得られ、２３℃の状態がレジスト膜厚が均一になることが判った。また、処理容器１６内の温度を２３℃とし、湿度を８０％，４０％及び２０％に変えてレジスト膜厚と膜厚形成時間との関係を調べたところ、図６に示すような結果が得られた。更に、処理容器１６内の温度を２３℃にし、レジスト膜厚を１２２００Åに形成する場合の湿度を８０％～２０％に変えて膜厚安定振り切り時間と湿度との関係を調べたところ、図７に示すような結果が得られ、湿度８０％の場合

の膜厚安定振り切り時間は２５ｓｅｃ，湿度６０％の場合の膜厚安定振り切り時間は１９ｓｅｃであるのに対し、湿度４０％の場合の膜厚安定振り切り時間は１６ｓｅｃ、湿度２０％の場合の膜厚安定振り切り時間は１３ｓｅｃであり、湿度８０％のに比べて湿度４０％の場合は９ｓｅｃの時間を短縮することができ、湿度２０％の場合には１２ｓｅｃの時間を短縮することができた。なお、処理容器１６内に供給される空気の流速は、０．３ｍ／ｓｅｃで一定とした。また、湿度を２０％以下にした場合の膜厚安定振り切り時間は、更に短くなると予測される。

【００３０】したがって、処理容器１６内の温度を２３℃にし、処理容器１６内の湿度を４０％以下に設定することにより、レジスト塗布時間を短縮することができると共に、レジスト膜の均一化を図ることができる。

【００３１】

【発明の効果】以上に説明したように、この発明のレジスト塗布装置によれば、処理室内を確実に低湿度雰囲気に維持することができるので、レジスト液中の溶剤の揮発時間を短縮することができると共に、レジスト膜の形成に要する時間を短縮させることができる。また、レジスト塗布工程以後の露光処理時間に合せてレジスト塗布処理を行うことができるので、プロセス全体の処理時間を短縮することができ、スループットの向上を図ることができる。

【図面の簡単な説明】

＊【図１】この発明のレジスト塗布装置を具備する半導体ウエハのレジスト液塗布・現像システムの一例の概略平面図である。

【図２】この発明のレジスト塗布装置の概略断面図である。

【図３】半導体ウエハのフォトリソ処理工程を説明するフローチャートである。

【図４】半導体ウエハのレジスト塗布工程を説明するフローチャートである。

【図５】処理雰囲気温度を変えた場合の半導体ウエハ表面のレジスト膜厚の変化状態を示すグラフである。

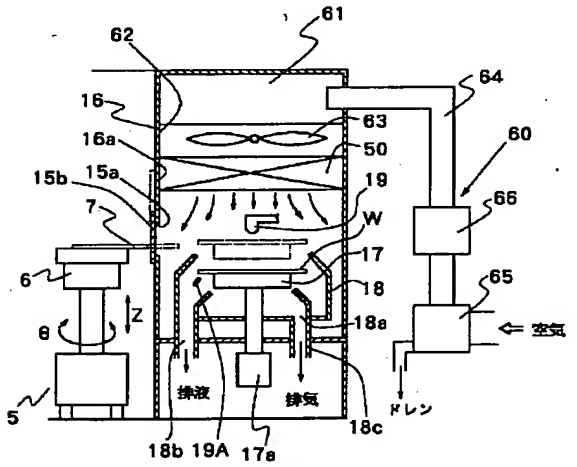
【図６】処理雰囲気湿度を変えた場合のレジスト膜厚と振り切り時間との関係を示すグラフである。

【図７】レジスト膜厚を一定にした場合の膜厚安定振り切り時間と湿度との関係を示すグラフである。

【符号の説明】

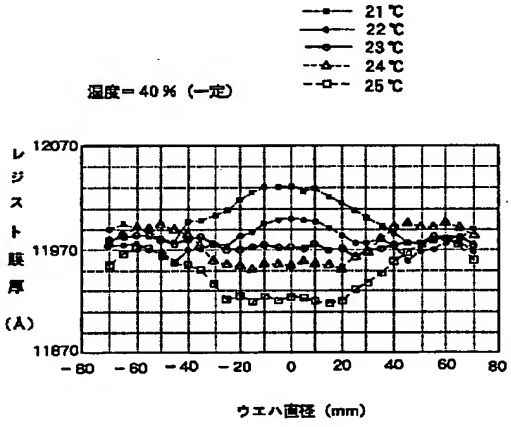
Ｗ　半導体ウエハ（被処理体）
１６　処理容器（処理室）
１６ａ　空気導入口
１７　スピンチャック（載置台）
１９　ノズル（レジスト液供給手段）
５０　ＵＬＰＡフィルタ
６０　乾燥空気供給機構
６４　乾燥空気供給路
６５　除湿器（除湿手段）
６６　温度コントローラ（温度制御手段）

【図２】

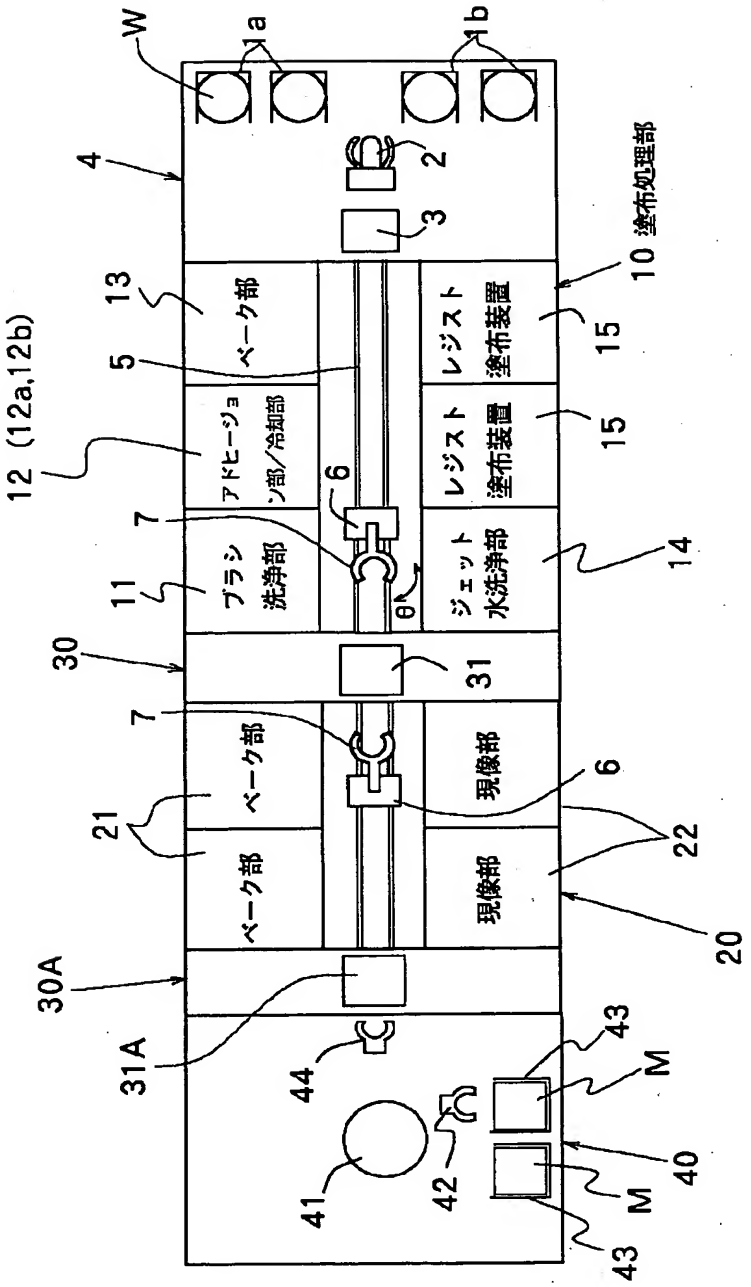


16：処理容器　60：乾燥空気供給機構
16a：乾燥空気導入口　64：乾燥空気供給路
17：スピンチャック　65：除湿器
19：レジスト液供給ノズル　66：温度コントローラ
50：ULPAフィルタ

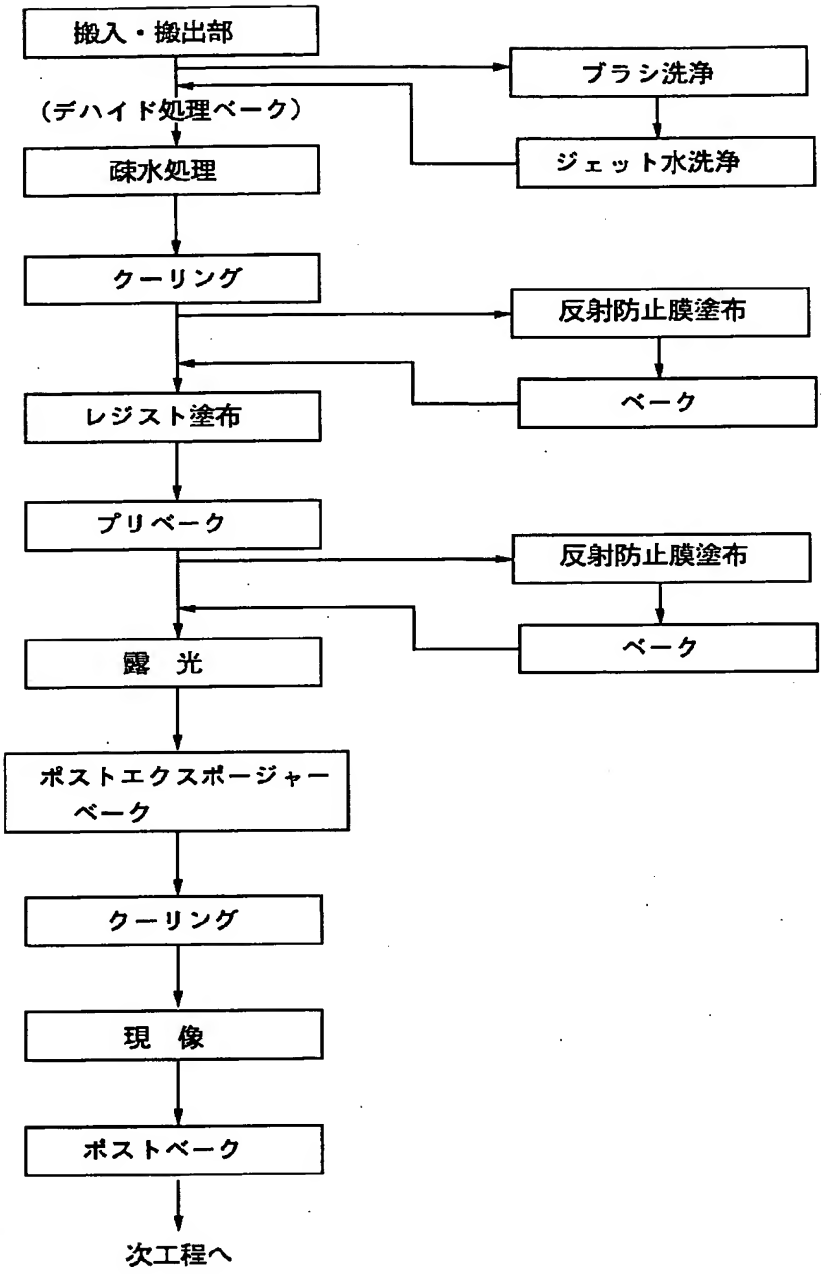
【図５】



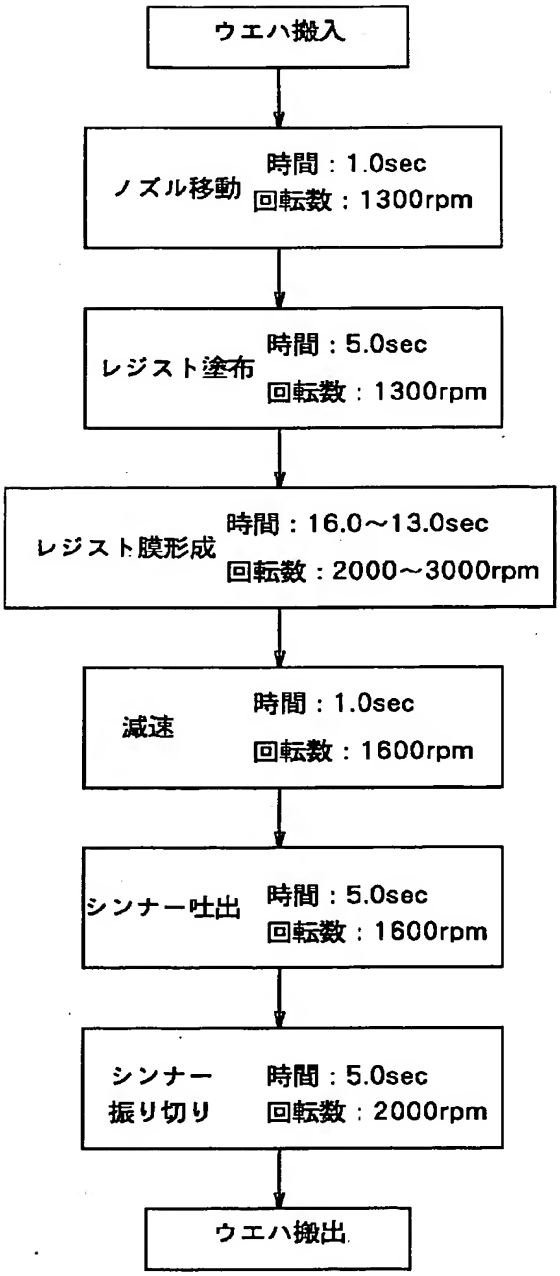
【図１】


W
1a
1b
2
3
4
10 塗布処理部
ベーク部
13
5
レジスト塗布装置
15
アドヒージョン部／冷却部
12 (12a,12b)
6
7
ブラシ洗浄部
11
θ
ジェット水洗浄部
14
30
31
ベーク部
現像部
21
22
20
30A
31A
44
43
M
41
42
40

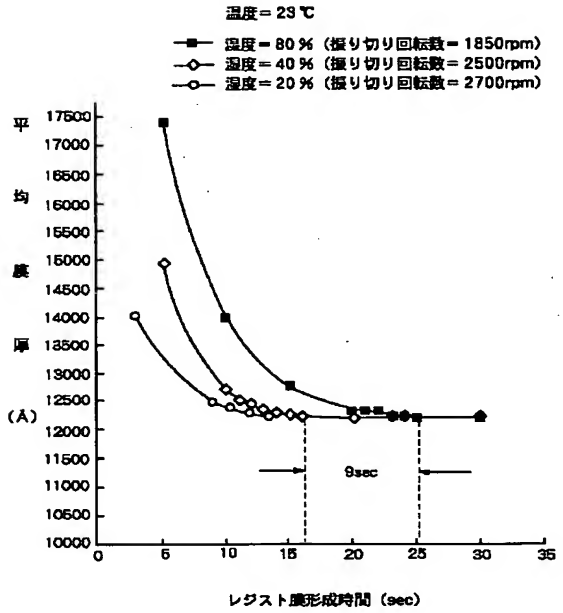
【図3】


搬入・搬出部
ブラシ洗浄
（デハイド処理ベーク）
ジェット水洗浄
疎水処理
クーリング
反射防止膜塗布
ベーク
レジスト塗布
プリベーク
反射防止膜塗布
ベーク
露　光
ポストエクスポージャー
ベーク
クーリング
現　像
ポストベーク
次工程へ

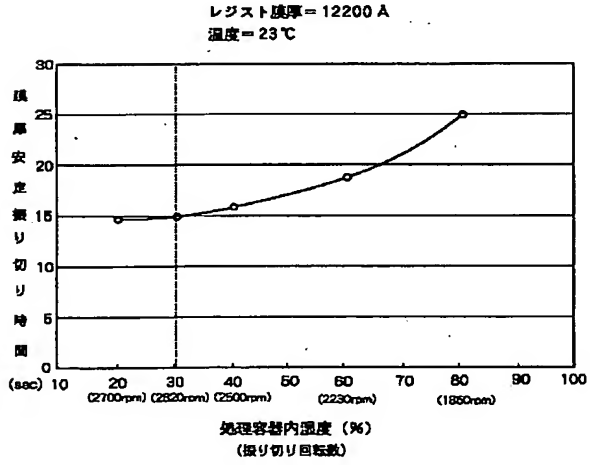
【図４】


ウエハ搬入
ノズル移動
時間：1.0sec
回転数：1300rpm
レジスト塗布
時間：5.0sec
回転数：1300rpm
レジスト膜形成
時間：16.0～13.0sec
回転数：2000～3000rpm
減速
時間：1.0sec
回転数：1600rpm
シンナー吐出
時間：5.0sec
回転数：1600rpm
シンナー
振り切り
時間：5.0sec
回転数：2000rpm
ウエハ搬出

【図６】


温度＝23℃
湿度＝80％（振り切り回転数＝1850rpm）
湿度＝40％（振り切り回転数＝2500rpm）
湿度＝20％（振り切り回転数＝2700rpm）
平均膜厚（Å）
17500
17000
16500
16000
15500
15000
14500
14000
13500
13000
12500
12000
11500
11000
10500
10000
0
5
10
15
20
25
30
35
9sec
レジスト膜形成時間（sec）

【図７】


レジスト膜厚＝12200 Å
温度＝23℃
膜厚安定振り切り時間
30
25
20
15
10
5
0
(sec)
10
20
30
40
50
60
70
80
90
100
(2700rpm)
(2620rpm)
(2500rpm)
(2230rpm)
(1850rpm)
処理容器内湿度（%）
（振り切り回転数）